NVM Express Technical Errata

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Affected Spec Ver.	NVM Express 1.0
Corrected Spec Ver.	

Submission info

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This erratum removes a minimum 4KB buffer size for PRP1 in several commands, which is not necessary and has caused confusion for those reading the specification.

This erratum clarifies when resources associated with a command are available for re-use.

This erratum adds the NVM Command Set specific error code value of Invalid Protection Information.

This erratum makes editorial changes to section 4.

The "Requested Command to Abort Not Found" error is removed. Whether a command was successfully aborted is reported in Dword 0 of the completion queue entry.

Description of the specification technical flaw

Modify PRP Entry 1 in Figure 50 (Get Features) as shown:

Bit	Description
63:00	**PRP Entry 1 (PRP1):** Indicates a data buffer that the Feature information shall be returned in if the Feature information is specified in a data structure. The buffer shall not have more than one physical discontinuity ~~and shall be 4KB minimum in size~~. If no data structure is used as part of the specified feature, then this field is not used.

Modify PRP Entry 1 in Figure 54 (Get Log Page) as shown:

Bit	Description
63:00	**PRP Entry 1 (PRP1):** Indicates a data buffer that the log page shall be returned to. The buffer shall not have more than one physical discontinuity ~~and shall be 4KB minimum in size~~.

Modify PRP Entry 1 in Figure 62 (Identify) as shown:

Bit	Description
63:00	**PRP Entry 1 (PRP1):** Indicates a data buffer that the Identify data structure shall be returned to. The buffer shall not have more than one physical discontinuity ~~and shall be 4KB minimum in size~~.

Modify PRP Entry 1 in Figure 69 (Set Features) as shown:

Bit	Description
63:00	**PRP Entry 1 (PRP1):** Indicates a data buffer that the Feature information is provided in if the Feature information is specified in a data structure. The buffer shall not have more than one physical discontinuity ~~and shall be 4KB minimum in size~~. If no data structure is used as part of the specified feature, then this field is not used.

Modify PRP Entry 1 in Figure 90 (Security Receive) and Figure 94 (Security Send) as shown:

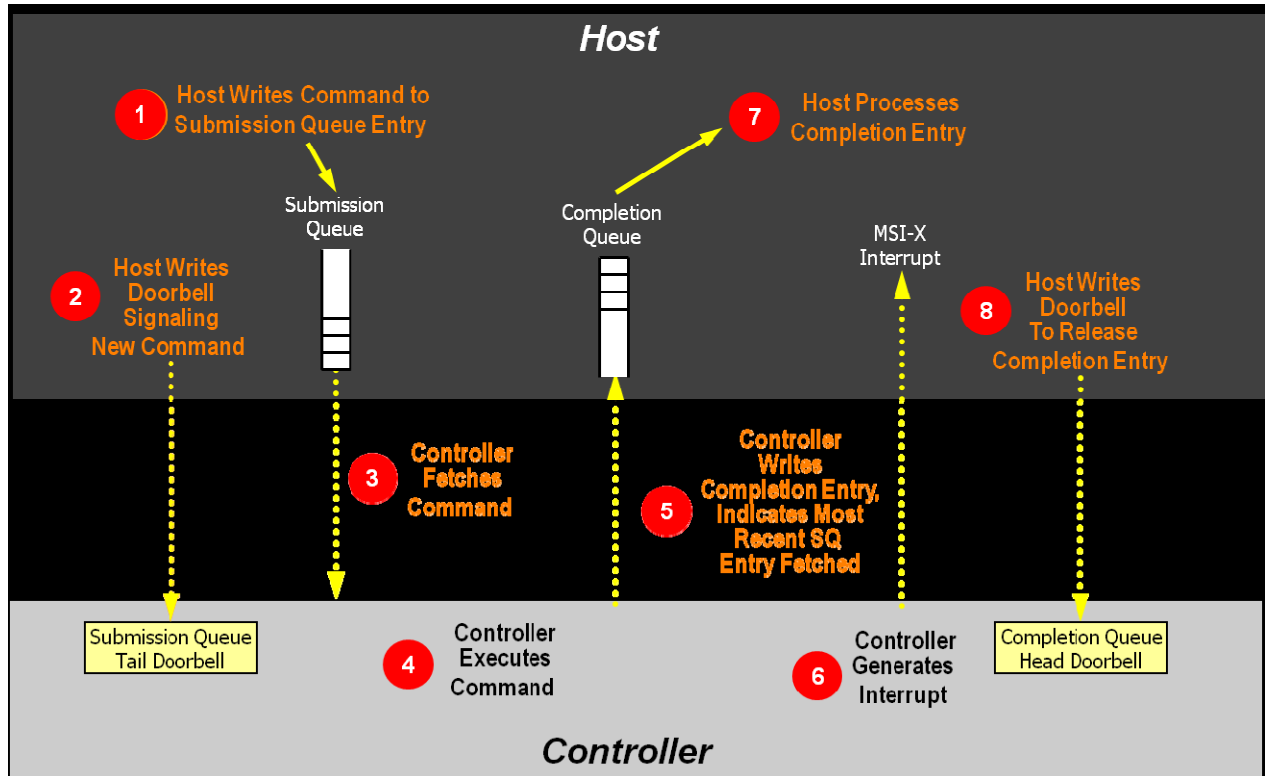| Bit	Description
63:00	**PRP Entry 1 (PRP1):** Indicates a data buffer that contains the security protocol information. The buffer shall not have more than one physical discontinuity ~~and shall be 4KB minimum in size~~.

Modify PRP Entry 1 in Figure 109 (Dataset Management) as shown:

Bit	Description
63:00	**PRP Entry 1 (PRP1):** Indicates a data buffer that contains the LBA range information. The buffer shall not have more than one physical discontinuity ~~and shall be 4KB minimum in size~~.

Modify step 5 of section 7.2.1 as shown below:

5. After the command has completed execution, the controller writes a completion entry to the associated Completion Queue. As part of the completion entry, the controller indicates the most recent SQ entry that has been fetched ~~that the associated Submission Queue entry is free for the host to re-use as part of communicating the latest Submission Queue Head value to the host~~.

Replace Figure 135 with the figure below, updating step 5 (indicates most recent SQ entry fetched):

Add section 7.2.4 as shown below:

7.2.4 Command Related Resource Retirement

As part of reporting completions, the controller indicates the most recent Submission Queue entry that has been fetched. Any Submission Queue entries that are indicated as being fetched may be re-used by host software.

If a completion queue entry is posted for a command, then host software may re-use the associated PRP List(s) for that command and other resources (an exception is the PRP List for I/O Submission Queues and I/O Completion Queues).

Modify Figure 19 as shown below:

Figure 1: Status Code – Command Specific Errors Values, NVM Command Set

Value	Description	Commands Affected
80h	Conflicting Attributes	Dataset Management, Read, Write
81h	Invalid Protection Information	Compare, Read, Write
82h	Attempted Write to Read Only Range	Write
~~81h~~ 83h - BFh	Reserved	

Modify section 4.5.1.2.1 as shown below:

Completion queue entries with a Status Code type of Generic Command Status indicate a status value associated with the command that is generic across many different types of commands.

Figure 16: Status Code – Generic Command Status Values

Value	Description
00h	**Successful Completion:** The command completed successfully.
01h	**Invalid Command Opcode:** The associated command opcode field is not valid.
02h	**Invalid Field in Command:** An invalid field specified in the command parameters.
03h	**Command ID Conflict:** The command identifier is already in use. Note: It is implementation specific how many commands are searched for a conflict.
04h	**Data Transfer Error:** Transferring the data or metadata associated with a command had an error.
05h	**Commands Aborted due to Power Loss Notification:** Indicates that the command was ~~commands are~~ aborted due to a power loss notification.
06h	**Internal Device Error:** The command was not completed successfully due to an internal device error. Details on the internal device error are returned as an asynchronous event. Refer to section **Error! Reference source not found.**.
07h	**Command Abort Requested:** The command was aborted due to a Command Abort command being received that specified the Submission Queue ~~ID~~ Identifier and Command ~~ID~~ Identifier of this command.
08h	**Command Aborted due to SQ Deletion:** The command was aborted due to a Delete I/O Submission Queue request received for the ~~SQ~~ Submission Queue that the command was issued to.
09h	**Command Aborted due to Failed Fused Command:** The command was aborted due to the other command in a fused operation failing.
0Ah	**Command Aborted due to Missing Fused Command:** The command was aborted due to the companion fused command not being found as the subsequent ~~SQ~~ Submission Queue entry.
0Bh	**Invalid Namespace or Format:** The namespace or the format of that namespace is invalid.
0Ch – 7Fh	Reserved
80h – BFh	I/O Command Set Specific
C0h – FFh	Vendor Specific

Figure 17: Status Code – Generic Command Status Values, NVM Command Set

Value	Description
80h	**LBA Out of Range:** The command references an LBA that exceeds the size of the namespace.
81h	**Capacity Exceeded:** Execution of the command has caused the capacity of the namespace to be exceeded. This error occurs when the Namespace Utilization exceeds the Namespace Capacity, as reported in Figure 67.
82h	**Namespace Not Ready:** The namespace is not ready to be accessed. The Do Not Retry bit indicates whether re-issuing the command at a later time may succeed.
83h – BFh	Reserved

Modify section 4.5.1.2.2 as shown below:

Completion queue entries with a Status Code Type ~~type~~ of Command Specific Errors indicate~~s~~ an error that is specific to a particular command opcode. Status codes of 0h to 7Fh are for Admin command errors. Status codes of 80h – BFh are specific to the selected I/O command set.

Figure 18: Status Code – Command Specific Errors Values

Value	Description	Commands Affected
00h	Completion Queue Invalid	Create I/O Submission Queue
01h	Invalid Queue Identifier	Create I/O Submission Queue, Create I/O Completion Queue, Delete I/O Completion Queue, Delete I/O Submission Queue
02h	Maximum Queue Size Exceeded	Create I/O Submission Queue, Create I/O Completion Queue
03h	Abort Command Limit Exceeded	Abort
04h	~~Requested Command to Abort Not Found~~ Reserved	~~Abort~~ Reserved
05h	Asynchronous Event Request Limit Exceeded	Asynchronous Event Request
06h	Invalid Firmware Slot	Firmware Activate
07h	Invalid Firmware Image	Firmware Activate
08h	Invalid Interrupt Vector	Create I/O Submission Queue
09h	Invalid Log Page	Get Log Page
0Ah	Invalid Format	Format NVM
0Bh – 7Fh	Reserved	
80h - BFh	I/O Command Set Specific	
C0 - FFh	Vendor Specific	

Modify section 4.5.1.2.3 as shown below:

Completion queue entries with a Status Code Type ~~type~~ of Media Errors indicate an error associated with the command that is due to an error associated with the NVM media.

Figure 20: Status Code – Media Errors Values

Value	Description
0h – 7Fh	Reserved
80h – BFh	I/O Command Set Specific
C0h – FFh	Vendor Specific

Figure 2: Status Code – Media Errors Values, NVM Command Set

Value	Description
80h	**Write Fault:** The write data could not be committed to the media. This may be due to the lack of available spare locations that may be ~~is~~ reported as an asynchronous event.
81h	**Unrecovered Read Error:** The read data could not be recovered from the media.
82h	**End-to-end Guard Check Error:** The command was aborted due to an end-to-end guard check failure.
83h	**End-to-end Application Tag Check Error:** The command was aborted due to an end-to-end application tag check failure.
84h	**End-to-end Reference Tag Check Error:** The command was aborted due to an end-to-end reference tag check failure.
85h	**Compare Failure:** The command failed due to a miscompare during a Compare command.
86h	**Access Denied:** Access to the namespace and/or LBA range is denied due to lack of access rights. Refer to TCG SIIS.
87h – BFh	Reserved

Modify the first paragraph of section 5.1.1 as shown below:

A completion entry is posted to the Admin Completion Queue when the command has been completed and a corresponding completion queue entry has been posted to the appropriate Admin or I/O Completion Queue. Dword 0 of the completion queue entry indicates whether the command was aborted. If the command was successfully aborted, then bit 0 of Dword 0 is cleared to '0'. If the command was not aborted, then bit 0 of Dword 0 is set to '1'.

Modify the first paragraph of section 5.1 as shown below:

The Abort command is used to cancel/abort a specific I/O command previously issued to the Admin or an I/O Submission Queue. Host software may have multiple Abort commands outstanding, subject to the constraints of the Abort Command Limit indicated in the Identify Controller data structure. An abort is a best effort command; the command to abort may have already completed, currently be in execution, or may be deeply queued. It is implementation specific if/when a controller chooses to complete the command ~~with an error (i.e., Requested Command to Abort Not Found)~~ when the command to abort is not found.

Modify Figure 27 as shown below:

Figure 3: Abort – Command Specific Errors Values

Value	Description
3h	**Abort Command Limit Exceeded:** The number of concurrently outstanding Abort commands has exceeded the limit indicated in the Identify Controller data structure.
~~4h~~	~~**Requested Command to Abort Not Found:** The command specified to abort was not found; the abort operation has failed.~~

Disposition log

4/13/2011	Erratum captured.
4/18/2011	Removed abort failure and reported whether command is aborted in DW0.
4/21/2011	Removed abort failure status code from two additional places in spec.
5/27/2011	Erratum ratified.

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